Field Office Technical Guide

Climatic Data for Massachusetts

Table of Contents

Introduction

The Natural Resources Conservation Service is charged with management of not only soil, but all five SWAPA resources (soil, water, air, plants, animals), and human considerations. SWAPA management requires an understanding of the resources, as well as interactions between resources. Many concerns about the resources can be addressed through climate information and specific climatic data.

Climate is an important factor driving the agriculture of a given region (along with soils, water available for irrigation, societal influences, economics, others). Under many situations, climate is THE determining factor which defines which crops can be grown in an area. For instance, although the soils and economics of Massachusetts may support growing cotton, the climate there (specifically temperature and precipitation) would not allow cotton to grow and mature.

This section concerning climatic data is oriented to the NRCS role in American agriculture and natural resource conservation. It describes the climatic data available for Massachusetts through the NRCS National Water & Climate Center (NWCC).

1 Climatic Data Element Descriptions, Measurement Methods, and Errors Associated with it's Collection.

The following description of climatic data elements is a condensation of the material contained in the *National Weather Service Observing Handbook No.2, Cooperative Station Observations*, the *Weather Station Handbook an Interagency Guide for Wildland Managers*, and the American Meteorological Society *Glossary of Meteorology*.

Statistical analysis of climatic data generates descriptive information which reflects the average atmospheric conditions at a location, as well as generating probabilities that extreme events will occur. Any statistical analysis of climatic data, due mainly to the limited number of samples available, must follow the rules for statistical analysis. An important rule governing small sample analysis requires a minimum of 30 samples. This does not mean that climatic data with less than 30 years of data can not be analyzed, but that some adjustment be made to estimate what a 30 sample set would produce.

AIR TEMPERATURE - Temperature is a measure of the hotness or coldness of air. It is measured on some definitive temperature scale. Two scales are commonly used. The Fahrenheit and Centigrade temperature scales establish the freezing of water at 32/0 degrees respectively and boiling point at 212/100 degrees respectively. The Fahrenheit scale is used most frequently in the US and Centigrade throughout the rest of the world. Air temperature is usually measured with either a liquid-in-glass maximum and minimum thermometer mounted in a vented, wooden box or with an electronic sensor.

It is important that thermometers be shaded from sunlight to avoid an erroneously high measured temperature. Instrument shelters are designed to rectify this problem. For more information on

instrument shelters, see the *Weather Station Handbook - an Interagency Guide for Wildland Managers*.

EVAPORATION - Evaporation is the physical process by which a liquid is transformed to a gaseous state. Evaporation is influenced by solar radiation, air temperature, vapor pressure, wind, and possibly atmospheric pressure. Evaporation varies with latitude, altitude, season, time of day, and sky condition. Accurate evaporation readings requires careful maintenance of an evaporation pan which contains water. The water depth is measured daily and adjusted for any precipitation which may occur.

PRECIPITATION - Precipitation refers to all forms of water, liquid or solid, that fall from the atmosphere and reach the ground. Precipitation includes, but is not limited to, rain, drizzle, snow, hail, graupel, sleet, and ice crystals. It is one of the most basic data elements collected by any climate station. Dew, frost and rime are excluded, since they are a result of water vapor in air condensing or freezing onto a surface.

The standard U.S. precipitation gage has an eight inch diameter mouth and height of about 30 inches. Non-recording gages simply collect precipitation; amount of precipitation must be measured by an observer. Recording gages have instrumentation which records the time, duration, and intensity of precipitation. Most recording gages store information on a paper strip, which is generally changed weekly by an observer. Precipitation intensity and duration, useful information for many NRCS design activities, can be derived from information gathered by precipitation gages.

The biggest factor in precipitation measurement error is wind. Strong winds during precipitation events can cause considerable differences between measured and actual precipitation. Measurement errors can also result from small amounts of dew, frost, and rime accidentally included in the total measured precipitation. Even with careful placement, all gages underestimate the real precipitation, particularly with snowfall.

NEW SNOW - New snow is the incremental amount of snow that has fallen since the last snow depth observation. Delineating between new snow and old snow presents a challenge. A snow board (generally a sheet of plywood) can provide an artificial surface at the top of the existing snow. Snow boards are laid on top of old snow when there is any possibility of new snow falling. After each observation of new snow, the board is cleaned and placed in a new location. Board placement and measurement location are the greatest source of error in determining new snow.

SNOW DEPTH - Snow depth is the actual depth of snow on the ground at the time of measurement. Snow depth is usually measured daily and determined to the nearest whole inch with a calibrated stick, such as that used with the 8-inch non-recording rain gage, or a ruler or yardstick. Snow should be measured in several locations and averaged to avoid errors induced by drifted snow.

SNOW WATER EQUIVALENT - The water equivalent of snow is the depth of water that would be obtained by melting the snow cover. Water equivalent of snow is continuously measured (weighed) by recording gages which are winterized with an antifreeze solution. For non-recording gages, the snow catch collected by the standard rain gage (with the funnel and small tube removed) is melted by adding a known amount of warm water. The total amount is then measured and the added amount of warm water subtracted to yield the observed water equivalent. Most snow water

equivalent measurement errors are associated with not selecting a representative location or the mechanics of subtracting water added to the total catch.

SOIL TEMPERATURE - Soil temperature measures the hotness or coldness of soil. Soil temperature is very important to the agricultural industry. Most seeds require a certain soil temperature in order to germinate. Soil temperatures are commonly measured at 2, 4, 8, 20, 40, 60, and 120 inches with the 4 inch reading being the most frequently observed. Readings are usually observed and recorded daily. Maximum, minimum, and current temperatures are generally recorded above 8 inches. At greater depths, where temperature changes more slowly, only the current temperature is normally recorded. Different species of plants have specific soil temperature ranges in which they will grow.

SOLAR RADIATION - INCOMING - Incoming solar radiation is the total electromagnetic radiation emitted by the sun striking the earth. Much solar radiation is absorbed by air molecules, reflected back into space, or refracted as it passes through the atmosphere. A pyrheliometer measures the direct solar radiation that passes through the atmosphere unimpeded. It consists of an enclosed radiation sensing element with a small aperture through which the direct solar rays enter. A pyranometer measures the combined incoming direct solar radiation and diffuse sky radiation. It is mounted such that it views the entire sky. Both instruments can be connected to electronic recording devices to collect the measurements. Solar radiation sensors must be cleaned regularly and exposed properly to accurately measure solar radiation.

WIND - Wind is the motion of air relative to the surface of the earth. Wind speed and direction, the two primary elements, are usually measured with an anemometer and wind vane, respectively. Wind speed is generally measured in miles per hour; direction is measured in degrees to the nearest ten(s) (10 to 360) with 360 degrees being north, 90 degrees being east, 180 degrees representing south, and 270 degrees being west. Wind measurement accuracy is primarily influenced by sensor height and nearby objects.

2 Climate Stations

Climate Stations are locations at which climatic data are gathered. Biographical and index information describing the climatic station, called "Metadata", are used in conservation applications and resource evaluations.

STATION ID - Identification number for the climate station assigned by the agency responsible for the particular station.

STATION NAME - The full name of the climate station as recognized by the agency responsible for the climate station.

STATION LATITUDE - Latitude defines a site's location based on its relative distance from the equator going toward the North or South poles. Station latitude is measured in degrees, minutes, and seconds, with 0 degrees being on the equator, and 90 degrees north or south being the North and South Poles, respectively. The latitude of a particular climate station is determined by the agency managing the station and is generally recorded to the nearest minute.

STATION LONGITUDE - Longitude defines a sites relative distance, up to 180 degrees, west or east of a North-South line running through Greenwich, England. The longitude of a particular station is determined by the agency managing the station. Measurement is generally made to the nearest minute.

STATION ELEVATION - The elevation of a climate station is usually measured in feet above mean sea level.

The National Weather Service compiles climatic data from a cooperative network of climate stations. The climate data generally recorded at these stations are daily precipitation and/or maximum and minimum temperature. Several other weather parameters may also be observed, such as evaporation, wind movement, and soil temperature.

3 *Climatic Data Analyses*

The Natural Resources Conservation Service's National Water & Climate Center provides the climatic data analyses needed by NRCS employees and offices to perform conservation activities.

Climatic interpretations (probabilities and statistical summaries) for temperature and precipitation, growing season, frost free periods, and wetland evaluations are available for selected weather stations in each state for the period 1961 to 1990. The climatic analyses are described in the following examples:

TEMPERATURE AND PRECIPITATION SUMMARY (TAPS)

The TAPS table gives a month by month summary and probability analysis of temperature and precipitation.

TAPS Station : AMHERST, MA0120
Start yr. - 1961 End yr. - 1990
Temperature: 30 years available out of 30 requested in this analysis
Precipitation: 30 years available out of 30 requested in this analysis

	Temperature (Degrees F.)						Precipitation (Inches)				
Month	avg daily max	avg daily min	avg	2 yrs in 10 will have max temp. >than	2 yrs in 10 will have min temp. <than	avg # of grow deg days*	avg	2 yrs in 10 will have less than	2 yrs in 10 will have more than	avg # of days w/.1 or more	avg total snow fall
January	33.8	11.5	22.7	57	-21	3	2.92	1.34	4.27	5	11.5
February	36.9	14.3	25.6	59	-16	9	2.93	1.48	4.20	5	11.0
March	46.6	24.6	35.6	74	0	50	3.23	1.89	4.43	6	6.3
April	59.3	33.8	46.5	84	16	218	3.64	2.24	4.90	6	1.2
May	71.2	44.3	57.7	90	27	546	3.89	2.10	5.47	7	0.0
June	79.2	53.8	66.5	93	36	793	3.81	2.05	5.36	7	0.0
July	84.0	58.8	71.4	96	42	971	3.75	2.05	5.25	6	0.0
August	82.0	56.8	69.4	93	37	911	3.67	2.00	5.14	5	0.0
September	74.6	48.8	61.7	91	29	646	3.39	1.70	4.86	6	0.0
October	63.8	38.1	51.0	82	18	349	3.43	1.83	4.83	5	0.0
November	51.0	30.3	40.7	73	10	111	3.80	2.34	5.11	7	2.5
December	37.6	18.6	28.1	61	-11	13	3.73	2.10	5.19	7	10.1
Yearly : Average	60.0	36.1	48.1	---	---	---	----	----	----	---	---
Extreme	99	-30	---	96	-22	---	----	----	----	---	---
Total	---	---	---	---	---	4620	42.19	34.81	48.56	72	42.6

Average # of days per year with at least 1 inch of snow on the ground: 68

*A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minumum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (Threshold : 40.0 deg. F)

FROST FREE DAYS (FROST)

The FROST table provides information on the average date of the last temperature below 24, 28, and 32 degrees Fahrenheit in the spring, and the average date of the first temperature below 24, 28, and 32 degrees Fahrenheit in the fall, at probabilities of 10, 20, and 50%.

```
FROST Station : AMHERST, MA0120
Start yr. - 1961   End yr. - 1990
Requested years of data:    30            Available years of data:    30
Spring:
  Years of missing data          24 deg =  0, 28 deg =  0, 32 deg =  0
  Years with no occurrence       24 deg =  0, 28 deg =  0, 32 deg =  0
  Data years used                24 deg = 30, 28 deg = 30, 32 deg = 30
Fall:
  Years of missing data          24 deg =  1, 28 deg =  0, 32 deg =  0
  Years with no occurrence       24 deg =  0, 28 deg =  0, 32 deg =  0
  Data years used                24 deg = 29, 28 deg = 30, 32 deg = 30
```

	Temperature		
Probability	24F or lower	28F or lower	32F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 2	May 10	May 25
2 year in 10 later than--	April 27	May 6	May 21
5 year in 10 later than--	April 16	April 29	May 12
First freezing temperature in fall:			
1 yr in 10 earlier than--	October 8	September 27	September 13
2 yr in 10 earlier than--	October 13	October 2	September 18
5 yr in 10 earlier than--	October 22	October 12	September 26

GROWING SEASON (GROWTH)

The GROWTH table gives average length of growing season using three index temperatures (32, 28, and 24 degrees Fahrenheit) at 10, 20, 50, 80, and 90% probabilities.

GROWTH Station : AMHERST, MA0120
Start yr. - 1961 End yr. - 1990
Requested years of data: 30 Available years of data: 30
Years with missing data 24 deg = 1, 28 deg = 0, 32 deg = 0
Years with no occurrence 24 deg = 0, 28 deg = 0, 32 deg = 0
Data years used 24 deg = 29, 28 deg = 30, 32 deg = 30

	Daily Minimum Temperature		
Probability	# days > 24F	# days > 28F	# days > 32F
9 years in 10	169	146	120
8 years in 10	176	153	126
5 years in 10	188	165	137
2 years in 10	201	178	148
1 year in 10	208	184	154

WETLANDS DETERMINATION (WETS)

The WETS table gives a month by month summary and probability analysis of temperature and precipitation. The table also provides average length of growing season using three index temperatures (32, 28, and 24 degrees Fahrenheit) at 50 and 70% probabilities.

WETS Station : AMHERST, MA0120
Latitude: 4223 Longitude: 07232 Elevation: 150
State FIPS/County(FIPS): 25015 County Name: Hampshire
Start yr. - 1961 End yr. - 1990

	Temperature (Degrees F.)			Precipitation (Inches)				
					30% chance will have		avg # of days w/.1 or more	avg total snow fall
Month	avg daily max	avg daily min	avg	avg	less than	more than		
January	33.8	11.5	22.7	2.92	1.73	3.54	5	11.5
February	36.9	14.3	25.6	2.93	1.85	3.54	5	11.0
March	46.6	24.6	35.6	3.23	2.27	3.84	6	6.3
April	59.3	33.8	46.5	3.64	2.64	4.29	6	1.2
May	71.2	44.3	57.7	3.89	2.58	4.67	7	0.0
June	79.2	53.8	66.5	3.81	2.51	4.57	7	0.0
July	84.0	58.8	71.4	3.75	2.50	4.49	6	0.0
August	82.0	56.8	69.4	3.67	2.45	4.40	5	0.0
September	74.6	48.8	61.7	3.39	2.14	4.09	6	0.0
October	63.8	38.1	51.0	3.43	2.26	4.11	5	0.0
November	51.0	30.3	40.7	3.80	2.76	4.48	7	2.5
December	37.6	18.6	28.1	3.73	2.54	4.46	7	10.1
Annual	-----	-----	-----	------	37.17	45.73	--	----
Average	60.0	36.1	48.1	------	------	------	--	----
Total	-----	-----	-----	42.19	------	------	72	42.6

GROWING SEASON DATES

	Temperature		
Probability	24 F or higher	28 F or higher	32 F or higher
	Beginning and Ending Dates Growing Season Length		
50 percent *	4/16 to 10/21 188 days	4/29 to 10/11 165 days	5/12 to 9/26 137 days
70 percent *	4/12 to 10/25 196 days	4/25 to 10/15 173 days	5/ 8 to 9/29 144 days

* Percent chance of the growing season occurring between the Beginning and Ending dates.

4 Climatic Data Analyses for Massachusetts

The following table summarizes the climatic analyses for the selected weather stations in Massachusetts and the stations are located on the map:

The climate map (PRISM) with average annual precipitation is shown in the following figure:

Map need to be downloaded from the WCC web site

5 References

The following are the National Water and Climate Center web sites associated with climate information:

WCC General Climate web site:
http://www.wcc.nrcs.usda.gov/water/w_clim.html

Field Office Guide to Climate Data web site:
http://www.wcc.nrcs.usda.gov/water/climate/foguide.html

Climate Data Retrieval for MA web site:
http://www.wcc.nrcs.usda.gov/water/climate/state.pl?state=ma

Climate map (PRISM) with average annual precipitation for MA:
http://www.ftw.nrcs.usda.gov/prism/prismmaps_2.html#Massachusetts

Other References:

Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1961-1990, Massachusetts, NOAA

6 *Climate Glossary*

The following lists terms which provide descriptive information for climatic datasets:

ALBEDO - The ratio of the amount of radiation reflected by a body to the amount of radiation incident upon it; expressed as a percentage.

CLIMATE - the synthesis of weather, or averaging of weather conditions over a given time period.

DEGREE DAYS, **COOLING** - A value used to estimate the energy requirements for air conditioning of homes and buildings. One cooling degree day is given for each degree the daily mean temperature is above 75 degrees Fahrenheit.

DEGREE DAYS, **GROWING** - Growing degree days (GDD) measures the day to day accumulation of the difference between the average daily temperature and a threshold temperature for a specific crop. GDD's give an indication of the amount of heat available for crop growth.

DEGREE DAYS, **HEATING** - A value used to estimate the energy requirements for heating homes and buildings. One heating degree day is given for each degree the daily mean temperature is below 65 degrees Fahrenheit.

DEWPOINT - The temperature to which air is cooled for water vapor to begin condensing.

DRIZZLE - Very small, numerous, and uniformly dispersed water drops that may appear to float while following air currents. Unlike fog droplets, drizzle falls to the ground.

DURATION - the period or time increment to which an observed or computed value applies.

EVAPORATION - Evaporation is the physical process by which a liquid is transformed to a gaseous state.

EVAPOTRANSPIRATION (ET) - The combined processes of evaporation and transpiration.

FOG - A visible collection of minute water droplets suspended in the atmosphere near the earth's surface. Fog reduces visibility below one kilometer (0.62 miles).

FREEZE - A freeze occurs at any time the surface air temperature reaches 28 degrees or less. This temperature causes damage to most vegetation except certain species which are resistant to freezing.

FREEZE FREE PERIOD - Freeze free period is the number of consecutive days where the air temperature does not fall below 28 degrees Fahrenheit.

FREEZE, **KILLING** - A killing freeze occurs at or below 24 degrees Fahrenheit and causes permanent damage to almost all vegetation.

FREEZE FREE PERIOD, KILLING - Killing freeze free period is the number of consecutive days where the air temperature does not fall below 24 degrees Fahrenheit.

FROST - Frost is the process of deposition of frozen atmospheric water vapor on surfaces whose surface air temperature is below 32 degrees Fahrenheit. A frost can occur at any time the surface air

temperature falls to 32 degrees Fahrenheit or less. This temperature may cause damage to very young vegetation or vegetation that has no resistance to frost. Most fruit falls in this category.

FROST FREE PERIOD - Frost free period is the number of consecutive days where the surface air temperature does not fall below 32 degrees Fahrenheit.

FROST, FIRST - First Frost is the first date following the growing season that the minimum temperature drops below an index temperature, usually 32 degrees Fahrenheit. The first frost usually occurs in the fall of the year, but it may occur during the winter months, or in some locations may not occur at all.

FROST, **LAST** - Last Frost is the last date preceding the growing season that the minimum temperature drops below an index temperature, usually 32 degrees Fahrenheit. The last frost usually occurs in the spring of the year but may occur very early in the summer or not at all in some locations. First and Last frosts are analyzed at three temperatures (32, 28, and 24 degrees Fahrenheit) specifically relating to damage caused to vegetation by the sub-freezing temperatures.

GROWING SEASON - Growing Season is the number of consecutive days where the temperature has not gone below an index temperature for specific vegetation. If vegetation is more resistant to cold temperatures the index temperature would be lower. The index temperatures used in growing season analysis usually include 24, 28, and 32 degrees Fahrenheit.

GROWING SEASON PERIOD - Growing Season Period is the period of time, beginning date and ending date, that defines the period that the temperature has not dropped below the index temperature.

HAIL - Precipitation in the form of balls or irregular lumps of ice with a diameter of 5 mm or more, always produced by convective clouds, nearly always cumulonimbus.

HUMIDITY, **RELATIVE** - A measure of the amount of water in the air compared to the amount of water vapor the air has the potential to hold. (Note: the potential of air to hold water changes with air temperature. Therefore, relative humidity can change as air temperature changes without an actual change in the amount of water vapor.)

INDEX TEMPERATURE - A temperature which denotes the beginning of a specific event such as 28 degrees Fahrenheit. The 28 degree temperature denotes a freeze that can damage plants.

NORMAL - "Normal" is an average of any of the climatic elements calculated for a specific time period. The beginning and ending years of the normal period are established by the World Meteorological Organization. This organization has defined the current standard averaging period for "Normals" as 1961 through 1990. Normals have been established as the standard period that will be used in analysis of climatic data to allow for comparable descriptive information representative of average conditions over the time period.

PERIOD OF RECORD - The time interval during which meteorological and climatic data have been gathered at a climatic station.

PRECIPITATION - Precipitation refers to all forms of water, liquid or solid, that fall from the atmosphere and reach the ground. Precipitation includes, but is not limited to, rain, drizzle, snow, hail, grapple, sleet, and ice crystals.

PROBABILITY - Probability is a statistical process that provides for the analysis of data to determine the potential of an individual value to occur at a specified time, in a given year, or in a given period of time. An example might indicate that a certain value has a 10 percent chance of occurrence in any year, or that the value has a chance of returning once in a period of ten years.

RAIN - Precipitation in the form of liquid water drops which have diameters greater than 0.02 in (0.5 mm).

WIND ROSES - A type of analysis that describes wind measurements graphically and tabularly as a combination of the cardinal direction that the wind was coming from and the average speed from that direction for a particular time interval.

SLEET - A type of precipitation consisting of transparent or translucent pellets of ice 5 mm or less in diameter. Sleet forms when raindrops fall through a layer of below-freezing air near the earth's surface.

SNOW WATER EQUIVALENT - The water equivalent of snow is the depth of water that would be obtained by melting the snow cover.

SOLAR RADIATION - The total amount of energy emitted by the sun.

SOLAR RADIATION, **INCOMING** - Incoming solar radiation is the total electromagnetic radiation emitted by the sun striking the earth.

TEMPERATURE - Temperature is a measure of the internal energy of molecular motion in a substance.

THRESHOLD TEMPERATURE - A temperature that denotes the boundary condition for a specific event. For example, a crop specific temperature below which the growth of that crop is minimal.

TRANSPIRATION - The process by which water in plants is transferred to the atmosphere as water vapor.

WEATHER - the instantaneous or short-term state of the atmosphere.

WIND - Wind is the motion of air relative to the surface of the earth.

7 Climatic Data and Conservation Practices

The following table provides recommendations on the most appropriate climatic data to use in analysis of the practice for application on a particular field. Values refer to the average or normal values for a particular element and time interval but may refer to a special type of analysis for that time interval ie. probability.

The Practice Names are linked to the appropriate standard which can be retrieved in \d;3.0";3.0";format by selecting the practice name.

			Elements			
Practice #	Conservation Practice Applied	Type	prec	temp	evap	wind
560	Access Road		F			
575	Animal Trails and Walkways		F			
310	Bedding		M	M	M	
314	Brush Management		F	M		
322	Channel Vegetation		F	M	M	
324	Chiseling & Subsoiling		M			
326	Clearing & Snagging		M	M		
397	Commercial Fishponds		F	M	M	
317	Composting Facility		M	M	M	M
327	Conservation Cover		F	M	M	
328	Conservation Crop Rotation		M	M	M	R
332	Contour Buffer Strips		F	M	M	
330	Contour Farming		M			
331	Contour Orchard and Other Fruit Area		M	M	M	
335	Controlled Drainage		F	M		
340	Cover & Green Manure Crop		M			
342	Critical Area Planting		F	M	M	M
589A	Cross Wind Ridges		M		M	R

589B	Cross Wind Stripcropping		M		M	R
589C	Cross Wind Trap Strips		F		M	R
348	Dam, Diversion		F		M	
402	Dam, Floodwater Retarding		F		M	
349	Dam, Multiple Purpose		F		M	
356	Dike	Earthen	F		M	
362	Diversion		F		M	
382	Fence		M			M
386	Field Border		M	M	M	
393A	Filter Strip		M	M	M	
394	Firebreak		M	M	M	
398	Fish Raceway or Tank		F	M	M	M
395	Fish Stream Improvement		F	M	M	M
399	Fishpond Management		M	M	M	M
400	Floodwater Diversion		F		M	
404	Floodway		F		M	
511	Forage Harvest Management		M	M	M	
655	Forest Harvest Trails & Landings		F		M	
490	Forest Site Preparation		M		M	M
666	Forest Stand Improvement		M		M	M
410	Grade Stabilization Structure		F		M	
412	Grassed Waterway		F		M	
548	Grazing Land Mechanical Treatment		M	M	M	
561	Heavy Use Area Protection		M	M	M	
422	Hedgerow Planting		M	M	M	
422A	Herbaceous Wind Barriers		M	M	M	R

423	Hillside Ditch		F		M	
320	Irrigation Canal or Lateral		M		M	
388	Irrigation Field Ditch		M		M	
464	Irrigation Land Leveling		M	M		M
552B	Irrigation Pit or Regulating Reservoir	Regulating Reservoir	M		M	
552A	Irrigation Pit or Regulating Reservoir	Irrigation Pit	M		M	
436	Irrigation Storage Reservoir		F		M	
442	Irrigation System	Sprinkler	F		F	
447	Irrigation System	Tailwater Recovery	F			
441	Irrigation System	Trickle	M	M	M	
443	Irrigation System	Surface & Subsurface	F	F	F	
430	Irrigation Water Conveyance	Pipeline	F		M	
428	Irrigation Water Conveyance	Ditch and Canal Lining	M	M		
449	Irrigation Water Management		FD	D	D	
460	Land Clearing		M		M	
453	Land Reclamation	Landslide Treatment	F		M	M
456	Land Reclamation	Highwall Treatment	F		M	
451	Land Reclamation	Fire Control	F	M	M	M
454	Land Reclamation	Subsidence Treatment	F		M	
455	Land Reclamation	Toxic Discharge Control	F	M	F	M
544	Land Reconstruction	Mine-Current	F		M	
543	Land Reconstruction	Mine-Abandoned	F		M	
466	Land Smoothing		M			
468	Lined Waterway or Outlet		M		M	
634	Manure Transfer		M	M	M	
457	Mine Shaft & Adit Closing		M		M	

482	Mole Drain		M			
484	Mulching		M	M	M	
590	Nutrient Management		M	M	M	
500	Obstruction Removal		M			
582	Open Channel		M		M	
512	Pasture & Hayland Planting		F	M	M	
595A	Pest Management		M			
516	Pipeline		M			
378	Pond		M		M	
521A	Pond Sealing or Lining	Flexible Membrane	M		M	
521B	Pond Sealing or Lining	Soil Dispersant	M	M	M	
521C	Pond Sealing or Lining	Bentonite Sealant	M		M	
521D	Pond Sealing or Lining	Cationic Emulsion-Waterborne Sealant	M	M	M	
521E	Pond Sealing or Lining	Asphalt-Sealed Fabric Liner	M	M	M	
462	Precision Land Forming		M			
338	Prescribed Burning		M	M	M	F
528A	Prescribed Grazing		M	M		
532	Pumped Well Drain		M			
533	Pumping Plant for Water Control		M		M	
550	Range Planting		F	M	M	
562	Recreation Area Improvement		M			
566	Recreation Land Grading & Shaping		M	M	M	
568	Recreation Trail & Walkway		M			
554	Regulating Water in Drainage Systems		M		M	
344	Residue Management	Seasonal	M	M	M	

329B	Residue Management	Mulch Till	M	M	M	
329C	Residue Management	Ridge Till	M			
329A	Residue Managment	No-till & Strip Till	M			
391A	Riparian Forest Buffer		F		M	
555	Rock Barrier		M			
558	Roof Runoff Management		F		M	
557	Row Arrangement		F		M	
570	Runoff Management System		F		M	
350	Sediment Basin		F		M	
571	Soil Salinity Management-Nonirrigated		M	M	M	
572	Spoil Spreading		M			M
574	Spring Development		F		M	
584	Stream Channel Stabilization		F		M	
580	Streambank & Shoreline Protection		F		M	
585	Stripcropping	Contour	M	M	M	
586	Stripcropping	Field	M		M	
587	Structure for Water Control		F		M	
606	Subsurface Drain		H		D	
607	Surface Drainage	Field Ditch	F		M	
608	Surface Drainage	Main or Lateral	F			
609	Surface Roughening		F			
600	Terrace		F		M	
610	Toxic Salt Reduction		F	M	M	M
612	Tree/Shrub Establishment		M	M	D	F
660A	Tree/Shrub Pruning		M	M		
614	Trough or Tank		M		M	

620	Underground Outlet	H		M
472	Use Exclusion	M		
630	Vertical Drain	M		
312	Waste Management System	M		M
313	Waste Storage Facility	F	F	F
359	Waste Treatment Lagoon	F		M
633	Waste Utilization	FD	M	M
636	Water Harvesting Catchment	F		M
641	Water Table Control	F		M
638	Water & Sediment Control Basin	F	M	M
640	Waterspreading	M		M
642	Well	M		M
351	Well Decommissioning	M		
657	Wetland Development or Restoration	F	M	M
645	Wildlife Upland Habitat Management	M	M	
648	Wildlife Watering Facility	F	M	
644	Wildlife Wetland Habitat Management	M	M	
380	Windbreak/Shelterbelt Establishment	F	M	M
650	Windbreak/Shelterbelt Renovation	F	M	M

M=monthly, D=daily, H=hourly, 15=15 minute, F=frequency, R=roses prec = Precipitation, temp = temperature Max & Min, evap = Evaportation, wind = Wind Movement